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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E. C. 3, England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Increasing numbers of inquiries are being received from various parts of the tropics which can be answered only by persons possessed of an intimate knowledge of local conditions. Enquirers should first satisfy themselves that their local Department of Agriculture is not able to supply them with the desired information before communicating with us. Correspondence which will be replied to is invited on all other matters pertaining to tropical agriculture, science and development.

THE SUGAR OUTLOOK.

THE present situation in the sugar market is causing grave anxiety to sugar producers in all parts of the world. Briefly, the condition of the market is this: production has increased to such an extent that prices have fallen to, or below, the cost of production with the result that producers are faced with the prospect of an indefinite period of unremunerative prices or, in many cases, heavy losses. Perhaps the most distressing features of the situation are the rapid accumulation of heavy stocks, in spite of low prices, coupled with reports of increasing production from most sugar producing areas. Examining the position in the United Kingdom we find that stocks of refined sugar amount to 168,000 tons compared with 22,000 tons a year ago, and stocks of unrefined amount to 246,000 tons compared with 125,000 tons last year. Reports from other consuming areas indicate similar conditions. The history of the origin of the present depression is a long and complicated one. The main historical factors have been the enormous increase in the output of European bounty-fed beet sugar, and the remarkable rise of the Cuban cane sugar industry stimulated by preferential treatment accorded by the United States of America. In 1913-14 the world production of sugar amounted approximately to 21,000,000 short tons of which cane sugar contributed nearly 53 per cent. and beet sugar a little more than 47 per cent. During the war the beet sugar industry of Europe experienced a severe set-back, the total production of beet sugar declining from 10,000,000 short tons in 1913-14 to less than 4 million short tons in 1919-20. This rapid reduction in the output of beet sugar resulted in a rapid rise in prices which, in turn, stimulated the production of cane sugar, the output of which rapidly rose from 10 million short tons to nearly 14 million short tons. Towards this increase Cuba contributed nearly 2 million short tons, the expansion being due almost entirely to the influx of American capital at an unprecedented rate. After the termination of the war the European beet sugar began to return to its pre-war dimensions with the result that the total sugar production is now almost 5 million tons greater than before the war.

The latest development in the situation, and one which has caused quite a flutter in sugar circles, is the proposal of Cuba to reduce its output by 500,000 tons during the next two or three years. The suggested mechanism is this, that no

new planting should be permitted, and that the commencement of the crushing season should be subject to Governmental regulation. A heavy tax will be levied upon all sugar in excess of 90 per cent. of the normal output, thus reducing the total output by about 500,000 tons. If we ignore the suggestion that natural conditions will result in a reduction of that amount of the Cuban crop irrespective of Governmental action, we arrive at the conclusion that the world output will be reduced by some 2 per cent. It is suggested in certain circles that the scheme will be analogous to the restriction scheme enforced in the production of plantation rubber. The comparison is, however, hardly justifiable when one bears in mind the fact that British possessions contributed 73 per cent. of the total output of rubber when the restriction scheme was introduced, whereas the production of sugar in Cuba is only about 20 per cent. of the world's total. Moreover, the restriction in the case of rubber amounted to the drastic reduction of 40 per cent., subsequently, in accordance with the mechanism of the scheme, increased to 50 per cent. Similar action on the part of Cuba would be not only futile but fatal. The proposed restriction of Cuba amounts only to 10 per cent. of a much smaller proportion of the world's supply. The more one examines the two crops, the conditions under which they are produced and the nature of the commodities themselves, the less real becomes the similarity between the two restriction schemes. The only hope for such a movement would be a concerted action upon the part of all, or the majority, of sugar producing countries and that possibility may shortly be dismissed as being beyond the realms of practical politics. It is suggested in some quarters that the immediate effect of the proposed restriction will be to stimulate the production of beet sugar upon the Continent, but, whether that be so or not, it is evident that the action of Cuba will be too limited in scope to have any fundamental reaction upon the market for sugar as a whole.

From the point of view of Cuba the proposal has much more significance. The prosperity of the Cuban sugar industry has rested mainly upon the fact that she has received from the United States of America preferential treatment with regard to sugar imports. The United States of America is the largest consumer of sugar in the world, the total imports in 1924 exceeding 5 million short tons. Of this total the insular possessions of the United States, whose sugar enters duty free, contributed nearly 1½ million tons. The imports of foreign sugar at full duty were negligible, amounting to little more than 100,000 tons. Cuba, with a reduction in tariff of 20 per cent. supplied the remainder. The net effect has been that Cuba, owing to this fiscal discrimination, has secured a monopoly of the large, lucrative and expanding United States sugar market, apart from the contributions of the insular possessions. Outside the United States, Cuba has been subjected to the same disabilities as other foreign nations, and it is only on account of the possession of the monopoly of the lucrative United States market that she has consistently been enabled to gain access to such markets as the United Kingdom—whose vacillating policy with regard to Empire sugar was recently described by a prominent member of the present Cabinet, Viscount Peel, as " a black spot in our economic and fiscal history "—at prices with which British producers could compete only with difficulty. Cuba has flooded the United States market, from which foreign producers are shut out, and a reduction of 500,000 tons in the output of Cuban sugar will amount to 10 per cent. of the United States consumption, and should have an appreciable effect upon the price of Cuban sugar in the States, without, at the same time, raising prices to such an extent as to stimulate the importation of foreign sugar. The effect upon foreign producers in general, and British producers in particular, is likely, therefore, to be negligible.

One of the main factors in the world's sugar industry as we have seen, has been the fiscal policy of the main consuming countries. Cuba has a monopoly of the United States market, European countries jealously protect their own beet sugar industries, but the British sugar producer has the monopoly of no large market, even though the United Kingdom is one of the greatest consumers of sugar. It is true that the English beet sugar producer has recently received bountiful assistance from the Government, it is equally true that the British producer of cane sugar has received a moderate preference from the same source, and, more important, that that preference has been stabilised for a period for ten years. All this is very satisfactory, but the main question is, whether the preference is sufficient to guarantee for the British producer a profitable market, consistent with the requirement that this sugar shall be produced upon a sound economic and competitive basis. Prominent politicians and business men closely in touch with this British industry have declared, in unmistakeable terms, that the existing preference is completely inadequate, and point with envy at the attitude of the United States towards her insular possessions, and the attitude of European nations towards their own national producing industries. *Tropical Agriculture* has studiously avoided the advocacy of controversial political problems. It is our policy, in this column, merely to record facts and offer non-controversial suggestions. We earnestly suggest that the time is ripe for a thorough investigation into the present condition of the British sugar industry. Whether such an investigation would reveal the necessity for an increased preference, or whether such an increase would be desirable and justifiable, are questions which we prefer to leave undiscussed, but it is evident that the promised help from the action of Cuba will prove illusory.

Readers are requested to inform the Editor immediately of any change in address.

CROP ROTATION.

The effect of one crop on another.

BY PROF. F. HARDY, M.A.

THAT continuous cropping of a soil by a plant species may result in diminished yields, has long been known to agriculturists. Hence, from the earliest times, rotation of crops has been practised in a more or less definite form to overcome this tendency. It was only in the early part of the nineteenth century, however, that the practice of crop rotation was generally accepted in well-established agricultural communities. Experience has subsequently accumulated to prove that, not only may one crop of a certain plant species adversely affect the growth of a following crop of the same species, but that one species may adversely affect even quite a different species if grown before it on the same soil.

Theories relating to the adverse mutual effects of crops.

Two chief theories have been evolved to account for these observations. The older theory maintained that plants excrete through their roots certain substances that exert varying degrees of toxicity on plants of the same or of different species grown in association with them, or planted after them. The root-excretion theory was urged mainly by de Candolle in his well-known book, *Physiologie Vegetale*, published in 1832 in Paris. It was based principally on the experiments of Macaire described in a memoir that was issued in the same year under the auspices of the Geneva Natural History Society. Macaire's experiments, which were mainly water-culture tests, were later severely criticised by numerous investigators who sought to prove that his results could just as well be explained in terms of differences in amounts of nutrients absorbed by different plants whose roots possessed specific selective powers. One notices here the effect of Liebig's teachings, which held sway in the middle of the nineteenth century, and which have largely dominated field experimentation even to the present day. There can be no doubt that the supply of soil nutrients, such as nitrate, potash and phosphate, is one of the chief factors deciding crop yields. Nevertheless, the disagreement between authorities regarding the mode of action of fertilizers, and their failure to arrive at a satisfactory basis for generalization in the use of fertilizers, even after an enormous number of field trials, has led to a realization of the possible existence of other factors controlling soil productivity. Among these additional factors, soil toxins have again been suggested as a factor of great importance.

The newer theory of soil toxins differs from the older, or de Candolle's theory, in that it ascribes the source of toxins, not to root-excretions of living plants, but to plant-débris undergoing decay under certain definite soil conditions. The chief exponents of the newer theory were the Duke of Bedford and Pickering in England, and Whitney, Cameron, Livingston and Schreiner in the United States of America. Bedford and Pickering made some remarkable experiments at Woburn on the harmful effects of grass on the growth of fruit trees (1897-1914). The American investigators (1903-1915) found that certain unproductive soils, as well as their water extracts, contained substances toxic to plants, and that their toxicity could be reduced by adding certain types of organic matter, oxidizing agents and chemical salts, including common fertilizers. Indeed, Schreiner and his associates (1900-1913) actually succeeded in isolating from soils several organic compounds that were found to be markedly toxic to plants. From this work there followed a general theory of the mode of action of fertilizers and manures which was widely propagated in American text-books of agronomy during the early years of the present century.

A recent extension of the soil toxin theory includes the deleterious action of soluble salts of certain metals, such as aluminium, iron and manganese, which appear in many instances to be causally related to soil acidity.

More recently still, plant parasitism has become recognised as an important factor in soil fertility. Parasitic micro-organisms are usually somewhat specific in their ability to attack higher plants, so that continuous cropping of the same or closely related plant species favours disease, and reduces crop yields. Nevertheless, parasitism alone hardly furnishes a sufficient basis for generalization regarding the reciprocal effects of crop plants. Furthermore, it is now known that certain soil micro-organisms, including protozoa, although not parasitic on higher plants, may actively destroy beneficial bacteria, and thus lower soil productivity.

Instances of harmful effects of one crop on another.

Many field experiments have demonstrated that one crop may specifically affect another. Daubeny (1845), at Oxford, England, was perhaps the first to study definite cases of such relationship. He grew barley, oats, beans, potatoes, clover and flax in continuous cropping or in definite rotation on small plots over a period of ten years. He found that rotations gave better yields than continuous cropping in most cases, but that in certain instances, the reverse appeared to obtain. Bedford and Pickering (1908) found that clover as well as grass may adversely affect the growth of apple trees, whereas weeds have lesser effect. They concluded that toxicity is not cumulative, but lasts only so long as the surface crop is growing, and may be lessened or annulled by adequate soil aeration. Certain varieties of apple trees were less affected than others. Bedford and Pickering reproduced many of their results by allowing the leachings from the surface crops, grown in perforated trays, to fall on to the soil surrounding the fruit trees. Hedrick (1905) in Utah, made similar observations on the effects of cereals, vegetable and small-fruit crops on young peach trees. He found that oats and rye were more injurious than tomatoes, potatoes, mustard and rape but that beans and crimson clover exerted beneficial effects when grown near peach trees. Fletcher (1912) at Gizeh in Egypt, demonstrated that maize greatly retarded the growth of sesame when planted in alternate rows, and that the

result was not affected by irrigating nor by fertilizing the soil. Skinner (1913) in California observed that cabbages did not grow well on peat soil that had previously grown sesame. A. Howard and G. L. C. Howard (1915) in Bihar, India, found that green manure crops must be turned in very early before satisfactory yields can be obtained with the tobacco crop planted afterwards. They also found that on heavy or water-logged soils, green manuring actually reduces the yield of tobacco, thus indicating the necessity of adequate soil aeration in tobacco culture. Hartwell and his co-workers (1919) at Rhode Island, U.S.A., found that the effects of various crops on those which followed were much reduced when the soil was limed to neutrality, and that they were not proportional to the quantities of plant nutrients removed from the soil. Sewell (1923) stated that it is a general observation that wheat does not give as high yields when grown after Kafir corn (*Andropogon sorghum*) as it does after Indian corn (*Zea mais*) in the Great Plains area of North America. Finally, Garner, Lunn and Brown have very recently (1925) demonstrated by precise experiments in Southern Maryland that the tobacco crop is especially sensitive to the effect of preceding crops. Many cropping systems were tested in attempts to obtain the highest possible yields of tobacco, but none of them was so beneficial as a continued previous resting condition, whereby the land was occupied for several years by natural adventitious vegetation. The use of soil-improving crops, including rotation grasses, combined with liming, but without the addition of fertilizers, resulted in practical failure of the tobacco crop. Certain preliminary tests indicated that the injurious effects of preceding crops on tobacco were derived from root-residues rather than from tops of the crop plants.

Conclusions.

The diverse and often unexpected results which follow when one crop is grown after another, should teach caution in the selection of plants to be grown in rotation. Generalizations based on experience with one particular crop plant or type (such as cereals), should not be applied indiscriminately to others. Even rotation legumes may not always exert the beneficial effects usually expected of them. Recommendations as to rotations to be practised should not be made by field officers unless adequately supported by precise and long-continued experiments. The effects of soil aeration and of climatic fluctuations appear to be especially signi icant in deciding the results of crop rotations, and even soil acidity may in certain cases be a controlling factor.

REFERENCES.

(1) Russell—*Soil conditions and Plant Growth*, Longmans Green, 4th Ed., 1921.

(2) Clements—*Aeration and Air Content*, Publication No. 315, Carnegie Institute, Washington, 1921.

(3) Howard—*Crop Production in India*, Oxford Univ. Press, 1924.

(4) Garner, Lunn and Brown—*Effects of crops on the yields of succeeding crops, with special reference to tobacco*, Journ. Agr. Research, XXX, 12, 15th June, p. 1094, 1925.

WEST INDIAN CONFERENCE.

THE Secretary of State for the Colonies has circularised the following agenda in connection with the West Indian Central Conference which will assemble in London during May:

1. General principles of the establishment of the Conference.
2. Constitution including—
   (*a*) representation of each Colony.
   (*b*) place, time and frequency of meetings.
   (*c*) subjects.
   (*d*) relation to specialised conferences.
   (*e*) procedure.
   (*f*) secretariat.
   (*g*) expenses.

This meeting of the representative delegates will afford opportunity for preliminary discussion of certain topics of general interest that are likely to come before the Standing Conference.

The following have been suggested for consideration as far as time admits:—

Marketing of produce in the United Kingdom;
Trade Representative for the West Indies in the United Kingdom;
Intercolonial migration of destitutes or unfit labourers;
Steamship communication with the United Kingdom;
Establishment of a Customs Union and Currency question with special reference to the establishment of West Indian metal currency.

Addresses will be delivered to the Conference by Mr. A. W. Hill on "Agriculture," Mr. Andrew Balfour on "Sanitation," and Mr. McDougall, Australian Representative on the Imperial Economic Committee, on "Grading of Produce."

As regards the further subject proposed by the British Guiana Members, *i.e.*, "Grant o Imperial Aid towards Establishment of Colonial Agricultural Banks," the Secretary of State has intimated that it would be quite useless to put this item on the Agenda and it has accordingly been omitted.

The Conference was opened on 13th May in the Moses Chamber of the House of Lords by the Rt. Hon. L. S. Amery, Secretary of State for the Colonies. In welcoming the delegates he assured them that the Colonial Office was not indifferent to the welfare of the West Indies and expressed the hope that he, himself, might shortly visit the islands. Sir Edward Davson, to whom the inception of the Conference is primarily due, stated, in reply, that the Conference was an attempt to create something definite and permanent to extend the spirit of co-operation. The delegates have attended a number of functions organised for their reception and had the honour of being received by His Majesty the King in the Throne Room.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

BOOKBINDING FOR THE TROPICS.

BY SIR ARTHUR E. SHIPLEY, G.B.E., F.R.S.

SINCE I wrote an article on "Enemies of Books" in the October and November (1925) numbers of *Tropical Agriculture*, I have accumulated a certain number of further facts as to the treatment of books in the Tropics. Dr. T. E. Snyder, Entomologist in the Bureau of Entomology, United States Department of Agriculture, has been good enough to send me the following paragraphs which are of considerable value in dealing with this difficult problem.

In 1908 a joint commission of the Bureau of Standards and the Library of Congress issued a memorandum in regard to certain experiments conducted by the Bureau of Standards, entitled, "Memoranda Relating to the Binding of Publications for Distribution to State and Territorial Libraries and Designated Depositories." This memorandum was published in 1908 by the Joint Committee on Printing, giving the recommendations based on the results of these experiments. Certain binding materials were found to be superior to others. The results of the experiments with poisons are also to be found in this memorandum which was published unnumbered. It may be stated with reference to these results that they are by no means conclusive.

One of the principal types of serious insect injury to books and paper in the Tropics is that caused by termites or "white ants." These insects usually infest books and paper when they are piled on modern shelving, in wooden book cases, or on flooring. Hence, injury by them is secondary to the injury to the woodwork.

There are various references in entomological literature to solutions for preserving books in the Tropics from attack by insects. The following is said to be effective :

1 oz. corrosive sublimate.
1 ,, carbolic acid.
2 pts. methylated or white rum spirit.

This solution should be lightly painted on both the outside and inside covers, especially along the margin and backs where paste has been used. It is reported to be effective in Jamaica for any kind of book cover and after the mixture has dried the books may be handled with perfect safety. Bookbinders in the Tropics are recommended to use a paste poison by adding one-half ounce of copper sulphate or bluestone to every pound of paste.

It is reported that in Porto Rico protection for a year or more can be obtained by painting the books and covers inside and out with the following solution :

1 oz. corrosive sublimate.
1 ,, carbolic acid.
1 qt. alcohol.

The books should not be handled until they are thoroughly dry.

In Cuba it is reported that books brushed lightly over the covers with

1000 cc. methylated spirit,
20 grms. bichloride of mercury,
25 cc. phenic acid,

adding sufficient shellac to produce a slightly adhesive liquid, is an effective preservative against insect attack.

A strong solution of shellac in spirit has also been recommended for use in other tropical countries. A solution of corrosive sublimate and thymol is reported to be an effective preservative as is also the addition of alum to the paste.

The Bureau of Entomology has experimented with various poisons which are to be added in the manufacture of various wood pulp products, such as the various composition wood fibre boards. Crude carbolic acid at the rate of one gallon per thousand square feet has proved effective in preventing attack by termites. Bichloride of mercury at the rate of 0.049 ounces per square foot has proved effective against these insects. Copper sulphate at the rate of 0.113 ounces per square foot has proved effective against termites. Additional experiments are being conducted with sodium fluoride, chlorinated naphthalene and dead oil or coal tar creosote. This Bureau's results with the latter substances are not as yet conclusive.

We would suggest that it may be found advisable to use binders made of asbestos as covers for books and paper in the Tropics and that these be bound together by metal—either spring or clips. If this is not practicable, we suggest that you use covers made of a wood fibre board treated with a chemical preservative, following the suggestions as outlined above.

I have also heard from Mr. Frank Cundall of the Institute of Jamaica to the following effect :—

"With regard to Mr. Dunlop's experience that French and German bound books are absolutely immune, it may interest you to know that in the binding of books for the Institute of Jamaica the preparation referred to by Dr. Thorpe has been in use for upwards of thirty-five years. It was efficacious until recently. When I complained to the Institute's Agents they sent me the astounding reply from the binders that whereas before the War they obtained their ingredients from Germany they had since obtained them in England, and they could only assume that they were less efficacious."

He further informs me that he is preparing a memorandum for the next issue of the *Handbook of Jamaica* on the "Preservation of Books in the Tropics" which will undoubtedly be of great value.

Finally, Mr. Cedric Chivers read a most able and helpful paper before the Royal Society of Arts on 22nd April of last year. Mr. Emery Walker, F.S.A., who was in the chair introduced Mr. Chivers as the most important binder outside London and a binder who had more to do with library binding than anyone else in the trade. Mr. Chivers does not deal with binding for the Tropics but his paper is full of interest. He has investigated all the

qualities of papers used in binding, and it is sad to reflect that these have been steadily deteriorating. He has experimented with the tearing strain of papers and has made many improvements in the actual method of binding: these are fully illustrated in the Journal of the Royal Society.

Some of the results regarding the actual binding are most surprising, and one fact becomes quite evident—that Nigerian leather is in every respect (with the solitary exception of vellum) the most capable of resisting the strain of various usages. The high value which is shewn by the Niger leathers is not a little surprising, when it is remembered that these leathers have been tanned by the natives of Nigeria. The Nigerian tanner, in his so-called ignorance, has been working along the lines of least resistance, allowing atmospheric conditions, temperature and time to operate, with results which give a more satisfactory result than can be obtained under civilised conditions. Further, severe tests under extreme conditions of heat, dryness and moisture have demonstrated that the native tanning of Nigerian leather more effectually preserves it from injury under bad conditions than any European tanning. Under conditions in which

Cowhide and Calf	..Lost 99 %	of its original strength.
French Levant Morocco	.. 87 %	do.
Persian hard grain Morocco	.. 83 %	do.
Thin Pigskin	.. 75 %	do.
Morocco	.. 70 %	do.
Thick Calf	.. 50 %	do.
Thick Hogskin	.. 27 %	do.
Niger Leather	.. 12 %	do.

vellum comes out first as having the highest resistance to tearing strain, but after that Nigerian un-pared comes second, Nigerian sheep skins third, Nigerian goat skins fourth, pared Nigerian leather fifth, soft Nigerian leather sixth. Pig skin comes twelfth, cow-hide and calf-hide come eighteenth. There is no doubt that Civilisation has much to answer for—at any rate in the preparation of leathers used for book-binding.

BARBERRY ERADICATION.

THE following note on eradicating the common barberry by means of chemicals, by N. F. Thompson (*Abs. in Phytopathology*. 13 (1923), *No.* 1, *p.* 48) is taken from the *Experiment Station Record*, December, 1925.

In the co-operative barberry eradication campaign conducted by the U.S. Department of Agriculture and 13 North-Central States, it has been found that abundant sprouting may occur after digging out the bushes, also that numerous bushes develop from seeds carried by animals. The killing effectiveness of chemicals is being tested, and certain promising results have been obtained. Of the chemicals studied (more than 40 in number) two have proved satisfactory as to cost, availability, and effectiveness, these being sodium chloride (about 10 lb. per average bush), applied at any season, and sodium arsenite solution (1 lb. to 5 gal. of water, at 2 gal. of the solution per bush), at least when applied during the growing season.

TAPIOCA.

TAPIOCA is a starch product obtained from the roots of the cassava plant which is extensively cultivated in tropical countries, but as far as the commercial use of its roots is concerned the only centre of production in the Empire is British Malaya.

Tapioca is shipped in two varieties, one for domestic, and the other for technical use. As regards domestic consumption in Great Britain, it is interesting to notice that different makes are favoured in different districts. In the South of England flake tapioca is in demand, whereas in Scotland the preference is for seed pearl tapioca the size of pinheads, or medium tapioca the size of peas. In industry the starch is used for the production of glucose, the manufacture of dextrin, for sizing yarns and fabrics, and the lower grades for the manufacture of adhesive paste.

London is a world market for tapioca, and receives far greater quantities for storage or transhipment than any other port. Owing to the financial facilities which it offers, buyers in many countries find it convenient to purchase on the London market. Before the war, sales were held in Mincing-lane every Tuesday, but since the war all business has been done by private treaty.

Tapioca is valued according to its whiteness, and is graded so as to avoid an excess of dust or broken pieces. It sells most freely when milk is plentiful and cheap, and is a serious competitor with rice for domestic purposes.

Imports of tapioca into Great Britain are not distinguished separately in the official returns but are included with those of cassava and mandioca. Of these three farinaceous substances, the following quantities were imported in 1924:—

From	Flake.	Pearl.	Flour and Powder.
	Cwts.	Cwts.	Cwts.
British Malaya ..	17,428	107,713	7,961
Other Empire ..	4	535	8
Total Empire ..	17,432	108,248	7,969
Foreign Countries ..	79,355	136,202	458,543

Java is the chief foreign supplier, and her exports to Great Britain in 1924 were valued at nearly £600,000. The disparity between the imports from the Empire and the Netherlands East Indies suggests that producers in British Malaya should concentrate on the manufacture of a higher grade product.

A CHIEF medical officer at a salary of £1,500 a year has been appointed to the Colonial Office to advise the Secretary of State upon all medical and sanitary matters arising in connection with the Colonies and Protectorates, including measures to ensure continuity of policy and co-ordination of progressive action between different administrations.

AGRICULTURAL NOTES.

COMPILED BY THE COLLEGE DEPARTMENT OF AGRICULTURE.

Value of Cane Trash.

THIS is a subject which has been referred to in previous numbers of *Tropical Agriculture*. The following extract gives an Australian view of the actual money value. Admittedly, the estimate may be high under existing circumstances in the West Indies. Nevertheless, its importance in the permanence of the sugar industry is so great under ordinary conditions of soil fertility and culture, that no harm can be done by over-estimating the value of field trash. On a large estate in Trinidad efforts are being made this year to pile field trash so that it may be available for rainy season littering of the pens and also for trials in the making of synthetic farmyard manure, by the Adco process, near the fields to be manured. This is a development which is being looked forward to with very great interest, since it offers a possibility of reducing the cost of livestock maintenance where mechanical methods can be successfully employed.

"A previous superintendent of the Queensland Sugar Bureau asserted very forcibly that when a crop of 20 tons of cane has been taken off an acre of land there is left in the field a crop of 5 tons of trash, and that this is worth 10*s*. per ton as manure, that is £2 10*s*. per acre. If a grower has 50 acres of cane cutting 20 tons to the acre, he has 250 tons of trash lying in the field worth £125. If he can cut 40 tons per acre the value of the trash would be £250. This is too valuable an asset to be destroyed by burning. The assertion that a ton of trash is worth 10*s*. was made in the later nineties, when the mills could only get £8 10*s*. per ton for their raw sugar f.o.b. and the farmers received only 11*s*. to 12*s*. for their cane. As the price of cane has advanced from 12*s*. to roughly 35*s*., that is an advance of 200 per cent., it will be within reason to also allow an increase in the value of the trash by, say, 100 per cent. The trash can thus be valued at 20*s*. per ton. The value of the trash on a 50-acre field at this rate if 40 tons of cane per acre have been taken off would be £500.

"Perhaps it may seem startling to some cane grower who has taken off 2,000 tons of cane from a 50-acre paddock that by burning the trash he is destroying £500 worth of valuable manure, and the best of all possible manure, because it is the only substance readily available to restore that humus to the soil which is constantly being removed by the fibre in the cane. It has to be remembered that the forming of this humus keeps the soil loose and mouldy, and retains moisture in dry seasons. Taking the estimate of Mr. Easterby, we find that about 3¾ million tons of cane should be harvested this year in Queensland. The trash left in the field will be about 750,000 tons, and taking the value at 20*s*. per ton, that means three-quarters of a million sterling is going up in smoke every year. In some instances it may be absolutely necessary to burn the cane before cutting; but still the top is left, that in itself is worth saving. Thus it is well within reason to say that half a million sterling of waste product is destroyed every year in our cane fields. It will be admitted by all that any effort to save or restore this waste of natural wealth should meet with ready support, more especially from the cane growers."

Coffee Seed Bed Sanitation.

WITH the stimulus given to coffee cultivation in regions adapted to this crop, the question of propagation of healthy vigorous plants only, becomes of first importance. A recent communication from Porto Rico points to the danger resulting from locating coffee seed beds in old plantations where root disease (*Rosellinia* sp.) is present. This fungus can live a saprophytic existence on the organic matter of the soil, which may retain infected material for an indefinite period. Early infection of the seedlings may result in death before transplanting size is reached, or the seedlings may be transplanted before the symptoms of disease have become manifest. Wilting of the leaves is usually the earliest symptom of the trouble, while evidence of the disease is often found on the roots and the crown of the plant where the fungus lives and produces its typical mycelium. There is also the danger of transferring infected soil from seed bed to plantation. The following brief preventive measures are recommended but planters are advised to consult their agricultural advisers should any signs of disease appear in their nurseries:—

1. Locate the seed bed where coffee has not been grown.
2. Do not use organic matter from coffee fields in the seed bed.
3. Transplant from healthy seed beds only and destroy all plants in infected seed beds.

Coconuts and Soil Fertility.

THE drain of plant food from the soil as a result of coconut cropping is not often sufficiently realised. In the West Indies, calculating on a basis of seven thousand nuts per ton of copra, seventy trees per acre, and fifty nuts per tree per annum, it will be found that one ton of copra should be produced from about two acres. This means an annual loss per acre, expressed in pounds, approximately, of potash 37.73, phosphoric acid 6·11, and nitrogen 52.78. These figures take into account the constituents in husk, shell, meat and water. The losses mentioned may be considerably diminished according to the methods of harvesting and disposal adopted. For example, if the nuts are split where they are collected, the water, rich in potash, would be returned to the soil. In the case of husk, shell and fallen leaves, it not infrequently happens that these are burnt away from the fields with the consequent loss of all

fertilising ingredients. Where the ashes are collected and returned to the plantation, the potash and phosphoric acid are recovered, but the nitrogen is lost. There is also the fact to be mentioned that burning such material inside the groves may do considerable harm to the root system of the palms and to the young spathes, resulting in the shedding of flowers and immature nuts from the latter. Losses are reduced to a minimum when all plantation refuse is left to decay in the fields producing it. This refers to general estate practice and obviously will not apply to cases of specific disease where it may be essential to destroy infectious material *in situ*.

FRUIT AND VEGETABLES.

Sterilization.

OUTBREAKS of disease in man may frequently be traced to the consumption of uncooked fruit and vegetables—especially those that are not peeled and green salads—and these usually occur from their being handled by individuals who are chronic passers of typhoid, dysentery or cholera germs or worm eggs or they have been contaminated by polluted soil or watered with polluted water and unfortunately the ordinary washing which they receive in the kitchen is inadequate to sterilise those that are eaten without the application of heat.

In *The American Journal of Hygiene*, Vol. V, 1925, R. G. Mills, C. L. Bartlett and J. F. Kessel contribute an article on "The Penetration of Fruits and Vegetables by Bacteria and other Particulate Matter, and the Resistance of Bacteria, Protozoan Cysts and Helminth Ova to Common Disinfection Methods." They conclude that pathogenic bacteria (those producing disease in man) do not penetrate into the interior of fruit or vegetables, except to a small extent at the site of decay or injury, but that the outsides of fruit and vegetables become increasingly contaminated from the time of picking. Fruit and vegetables may be regarded safe concerning bacteria after immersion in chlorinated water of a strength of ten parts of chlorine per million, but for protection against protozoal cysts (such as amoebic dysentery cysts) or worm eggs it required immersion of the fruit or vegetables in boiling water for ten to thirty seconds.

They give their conclusions as follows:—

1. Normal uninjured fruits and vegetables do not contain living bacteria within their tissues.
2. Finely divided particulate matter, such as carbon, corresponding in size to bacteria, protozoan cysts, and helminth ova, does not penetrate the stem-end of fresh vegetables to any appreciable extent.
3. Bacteria do not penetrate the unbroken skin of fruit and vegetables, kept under market conditions.
4. Bacteria, pathogenic to man, may gain entrance to fruit and vegetables through injured and decayed portions, where they may spread to a very limited extent, and may remain alive for seven to forty-two days. They may also contaminate the cut end of vegetables and remain viable for a similar length of time. It is, therefore, advisable to remove such portions before attempting sterilization.
5. Pathogenic bacteria may persist on the surface of fruits and vegetables kept under moist conditions for fifteen days or more. The gradual loss of moisture through the covering of fruits and vegetables, would tend to keep them viable longer than would be possible on perfectly dry surfaces. When such food stuffs are freshened with water, the viability would be influenced by the saprophytic flora normal to such an environment (*i.e.*: free living bacteria in water and soil that tend to kill off the disease producing ones).
6. Chlorination freed the surface of vegetable matter from pathogenic bacteria in every instance, but was not effective against cysts or ova.
7. Alcohol is ineffective in killing all protozoan cysts and helminth ova in sufficiently short periods of time to make it valuable as a disinfecting agent.
8. Potassium permanganate, in the concentrations ordinarily used, is not an effective disinfectant against helminth ova and protozoan cysts.
9. Burning alcohol on the surface of fruit and vegetables, or pouring boiling water over them, does not destroy all pathogenic organisms, either bacteria, cysts or ova. The heat does not sufficiently penetrate the crevices.
10. Dipping fruit and vegetable for ten seconds into boiling water, or water which remains above 80°C. during the immersion, is the only method thus far discovered, which will uniformly kill all pathogenic bacteria, protozoan cysts, and helminth eggs which might be found contaminating such food products, and render them safe for human consumption in an uncooked condition.

E.A.S.

ZANZIBAR.

THE Executive and Legislative Councils of Zanzibar were opened during March for the first time following the abolition of the Protectorate Council in 1914 when the protectorate was transferred from the Foreign Office to the Colonial Office. In performing the opening ceremony, His Highness the Sultan referred to the recent Conference of Governors at Nairobi to co-ordinate policies. The British Resident, President of the Council, declared "we are now at the beginning of a new chapter in the history of the Zanzibar Protectorate."

EPIPHYTES ON CULTIVATED TREES.

BY W. N. SANDS.

[*This article is reproduced from the "Malaya Agricultural Journal," Volume XIV, No. 1, January, 1926, when it was accompanied by six plates.*]

As certain epiphytes found on cultivated trees locally are often mistaken for parasitic plants, it may perhaps be useful to describe briefly some of them and the manner of their growth in the lowlands of Malaya.

An epiphyte, as its name implies, is a plant which grows on other plants, but it is not parasitic on them and is not usually attached to the soil. It is sometimes termed an air-plant. In the hot humid climate of Malaya, epiphytes occur in large numbers on numerous jungle and cultivated trees so that trunks and branches and even twigs and leaves are often completely covered with them. They belong to widely dissimilar classes of plants, such as lichens, mosses, ferns, orchids and other flowering plants, but the most noteworthy, from a planter's standpoint, are several species of fern and certain flowering plants. These air-plants occupy various sites on trees and may be observed growing in the forks of branches; in depressions caused by or following wounds; on the rough bark of dicotyledonous trees, on the smooth stems of coconut and other palms; and also at the bases of the leaves of palms; more especially those species whose leaves remain attached to the stem for long periods, such as, for example, the African Oil Palm (*Elaeis guineensis*, Jacq.).

The epiphytes on cultivated trees thrive better in sheltered places where the rainfall is heavy or well distributed and where there is a certain amount of overhead shade than elsewhere, and further, these air plants generally possess specialised organs which enable them to exist in the peculiar situations they occupy even when water is scarce. Among the devices for storing and conserving water during dry periods are thick and fleshy leaves, thick cuticle, sunken stomata or breathing pores, swollen stems, enlarged leaf-bases and roots covered with a thick spongy covering by means of which water is absorbed and retained as in most epiphytic orchids and aroids.

Most air-plants possess suitable mechanisms which enable their spores and seed to be successfully disseminated. By means of these they can reach new sites and carry on their existence. Their spores and seed are particularly well adapted for dispersal by the wind and by birds, and these are the chief agents, as far as is known, which carry the spores and seed from place to place.

The young plants even in the earliest stages of growth are able to fasten themselves securely to their supports by means of clinging or anchoring roots, so that they are not easily detached from the sites they occupy.

Epiphytes obtain their mineral food substances from decaying organic matter (humus) and not from the plants on which they grow. This humus is derived from dead leaves and other plant debris which collects around the plants. Some air-plants, *e.g.*: certain species of orchid, have their roots so interwoven in a loose net-like manner that these serve to collect organic matter as it becomes available. Again some of the large ferns such as the Oak-leaved Fern (*Drynaria quercifola* L.) and the Stag's Horn Ferns (*Platyceriums pp.*) produce peculiar leaves which are arranged in the form of a pocket against the trunk or branch of the supporting tree in which humus is retained, whilst the Bird's Nest Fern (*Asplenium nidus* L.) has its leaves arranged in a rosette, the bases of which slope inward to form a funnel in which food material collects.

As a rule, numerous roots are produced but these serve only to anchor the plant securely to stem or branch and to absorb food as it becomes available from the sources already described; they are not able to enter the living tissues of the trees on which they grow to secure food materials; therefore, epiphytes, unlike mistletoes, are not capable of parasitizing cultivated trees.

The chief local epiphytes on useful trees may be classed under three heads, (*a*) true epiphytes, (*b*) half epiphytes, and (*c*) nest epiphytes.

True Epiphytes are plants which are able to obtain all their food and water from the surface of the supporting tree, and from the atmosphere. In this class may be placed numerous flowering plants notably orchids and ferns. Good examples of these are the Pigeon Orchid (*Dendrobium crumenatum*, Swartz,) and the common Sakkat ribu-ribu (*Drymoglossum heterophyllum*, L.). It should be mentioned, however, that numerous plants which thrive epiphytically, more particularly many species of fern, are often able to grow equally well on the ground. *Half-Epiphytes* are air-plants which pass through their earlier stages of development on trees, but subsequently become connected with the ground. Excellent types of these furnished by species of Fig, such as the Banyan Fig (*Ficus bengalensis*, L.), *Ficus Benjamina*, L., *F. Indica*, L., *F. elastica*, Roxb., and others The seed of these germinate on the trees and the young plants at the outset have to subsist on such food materials as occur in the hollows and crevices of the bark of the tree on which they grow until their long aerial roots reach the soil. Whilst *Nest Epiphytes* comprise plants which, as mentioned above, collect humus in pockets or funnels by means of specialised leaves arranged in a particular and effective manner.

Among true epiphytes found on useful trees which may cause damage if allowed to over-run them, particular mention should be made of the common creeping ferns, *Drymoglossum heterophyllum*, L., and *Cyclophorus adnascens*, Desv., and the small creeping flowering plant, *Dischidia Gaudichaudi*, Dene.

The fern *Drymoglossum heterophyllum*, L., known to the Malays as Sakat ribu-ribu, is very commonly found on rubber, coconut, fruit and shade trees. It has a long, slender creeping rhizome, with fronds of two kinds, barren and fertile. The barren frond, which as a rule lies flat against the stem of the supporting tree, is roundish or oblong leathery, fleshy and is either almost sessile or shortly stalked. The apex of the leaf is rounded, the edge entire with the base obliquely or regularly wedge-shaped. The fertile frond is much longer, narrower, and with a longer stalk than the barren one, and does not rest against the stem or branch of the host tree. The sori which contain the spores are arranged in dense broad marginal lines on the under surface of the frond and may cover the whole of it.

This fern is often seen almost covering completely the stems of palms such as the Coconut (*Cocos nucifera*, L.) and the Pinang (*Areca catechu*, L.), and the trunks, branches and twigs of fruit trees.

Frequently found associated with *Drymoglossum* is the other small creeping fern, *Cyclophorus adnascens*, Desv. This also has a long thin creeping rhizome, and dimorhpous fronds. The barren frond is oblong, linear or spathulate, leathery and short stalked. The apex is blunt, the edge entire and the base gradually narrowed. The fertile frond is shortly stalked, linear and larger than the barren one, and has its edges more or less curved. The sori are small and occupy the upper half of the frond. This fern may be easily mistaken for a form of the *Drymoglossum*, but its narrower, longer, and somewhat thinner fronds which do not lie flat against the stem of the tree easily serve to distinguish it from the latter.

The other plant mentioned, namely, the Asclepiad (*Dischidia Gaudichaudi*, Dene.) which is sometimes termed "Petis" locally also has a slender climbing stem rooting at the nodes. It has small fleshy opposite ellipsoid leaves which lie flat against the stems of the supporting trees. They become thick and turn yellow in colour in exposed air situations. The flower is small and white. The fruit is 1¼ inches long and very narrow and contains several small plumed seeds. This plant grows rapidly and quickly covers the stems, twigs and leaves of fruit and other trees and damages them severely if allowed to remain.

Some of the half-epiphytes, namely, certain species of Ficus, or the Ara trees of the Malays are capable of destroying useful trees by means of their strangling aerial roots and the overhead shade of their leaves. The fruit of these figs is sought after by birds and possibly bats, and readily disseminated by them. It is no uncommon sight to see fig plants growing well on the towers and roofs of lofty buildings as well as on high trees, to which sites the fruit had originally been carried by birds or bats. At the outset the young plants have to subsist on any food they can obtain in the cracks and crannies of their supports, until their long rope-like aerial roots reach the ground and obtain food materials from the soil. On trees other branching roots encircle the stems and by pressure resulting from growth have a strangling effect on them, whilst the leafy growth of the branches of the epiphytes has a devitalizing effect also, owing to the thick shade formed so that the supporting trees are gradually killed.

In regard to the nest-epiphytes which include several species of fern, such as the Oak-leaved Fern (*Drynara quercifolia*, L.), the Bird's Nest Fern (*Asplenium nidus*, L.) and the Stag's Horn Ferns (*Platycerium spp.*), these may not be capable of damaging the useful trees to the same extent as the species described in the other classes, still they are often seen in the hollows or covering stems or branches below which are damaged or wounded areas, and by retaining plant debris or moisture, they may hasten the decay of stem or branch.

Although the superficial and herbaceous character of the growth of many of the epiphytes is not harmful provided that such growth does not cover wounded or diseased areas, or the twigs, leaves and inflorescences of the supporting trees, yet, as has been shown, several species are capable of causing quite extensive damage if allowed to develop. It is desirable, therefore, to remove all epiphytes, especially those on rubber or fruit trees, if this can be done without injury to the trees. As a general rule, epiphytes should be treated as weeds and removed as soon as seen, because after certain of them have made extensive growth their successful eradication becomes a very difficult and expensive operation. It is recorded from India that following the removal of epiphytic growths from the trunks of rubber trees that patch-canker was more prevalent than before and caused much damage, so that when detaching epiphytes care should be taken that the bark of the trees is not injured.

In the case of coconuts it is no uncommon sight to see the creeping ferns *Drymoglossum heterophyllum* and *Cyclophorus adnascens* almost completely covering the upper portions of the stems of large numbers of old palms in plantations and gardens. Although so common, these ferns rarely appear to extend above the bases of the leaves of the coconut palm and reach the inflorescences so that it is doubtful if they are capable of causing any damage to this tree. On the other hand, African Oil Palms (*Elaeis guineensis*, Jacq.), are frequently seen with their inflorescences and fruit almost completely covered by strong growing epiphytic ferns such as *Nephrolepis exaltata*, L. *N. acutifolia*, Dene, and other species.

When writing the earlier portion of this article reference was made to (*a*) Dr. A. W. Schimper's Plant Geography (1903), and (*b*) Dr. J. C. Willis' Flowering Plants and Ferns (1908).

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture* post free, to anyone interested in tropical development.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

The Nature of Enzymes.

Professor Richard Willstätter, the famous German biochemist, in a recent address before the German Chemical Society, stated that so far it has been found impossible to isolate enzymes in the pure state. Enzymes apparently belong neither to the proteins, carbohydrates nor to any of the other well-known classes of biochemical substances. Chemical and precipitation reactions of enzymes are still almost unknown, because nearly all their properties are influenced by accompanying substances. The enzyme molecule appears to be composed of a colloidal carrier and a purely chemically-acting active component. The nature of the carrier is variable; it is dispensible, if another more suitable carrier is available. The enzyme may spontaneously alter its state of aggregation. It has not yet been possible to separate the chemically-acting component from the protecting carrier-colloid, without seriously imparing its reactivity.

The Manufacture of Viscose.

Viscose, or artificial silk, is manufactured from wood-pulp or from cotton, as well as from certain other types of cellulosic material. Sulphite-bleached wood-pulp, obtained from Canada, Norway and Sweden, furnishes the raw material for practically 80 per cent. of the viscose at present manufactured. When the pulp arrives at the artificial-silk factory, it is in the form of sheets, and contains very little wax, resin and mineral matter. After drying at 30°C., the sheets are dipped into 18 per cent. caustic soda solution. Excess of soda is pressed out, and the pulp is disintegrated into a fluffy mass. It is then "aged" by storing for two or more days, after which it is treated with carbon bisulphide under pressure. An orange-red mass (xanthogenate) results. This is easily soluble in dilute caustic soda (7 per cent.), yielding a honey-coloured viscous solution, from which fibres are spun. The solution is usually stored for some time before spinning, otherwise undesirable properties develop in the threads.

Spinning is executed by forcing the solution through spinnerets into a coagulating bath consisting of 10 per cent. sulphuric acid solution, containing sulphates of ammonia, sodium and zinc, together with a little sugar. This decomposes the xanthogenate compound into cellulose hydrate. Residual sulphur is next removed by immersion in a solution of sodium sulphide. The yarn is finally bleached with chlorine water, washed with dilute hydrochloric acid, centrifuged, and dried. F. G. Oliver, in *Industrial Chemist*, April, 1926.

The Citrus Pectin Industry.

The Exchange Lemon Products Company of Corona, California, has recently doubled the size of its plant for manufacturing citrus pectin from lemon waste. The production and sales of citrus pectin are increasing rapidly, and further expansion is contemplated. Dry pure citrus pectin is a new commodity that is finding many uses in addition to that of the manufacture of jellies and jams.—News Edition, *Indus. Engin. Chem.*, 10th May, 1926.

The Determination of Reducing Sugars in Sugar Factory Products.

The usual procedure in the past for determining reducing sugars in cane sugar laboratories, has consisted in a volumetric measurement of the amount of liquid containing the sugars (cane-juice, diluted molasses, raw-sugar solutions, &c.), that is required to reduce a known volume of standard Fehling's copper solution, the end-point being detected by the use of an external indicator (acidified potassium ferro-cyanide). A simpler method is now available, however, in which an *internal* indicator, methylene blue, is employed. The method is fully described by Messrs J. H. Lane and L. Eynon in the *Journal of the Society of Chemical Industry*, London, 26th January, 1923, Vol. 42, No. 4, p. 32 T. Their standard method of titration is as follows :

10 or 25 cc. of Fehling's solution are measured into a 300 or 400 cc. conical flask, and treated cold with almost the whole of the sugar solution required to effect complete reduction of the copper. (The approximate volume of the sugar solution is best ascertained by a preliminary rapid titration). The flask containing the cold mixture is heated on wire gauze until the liquid boils. Ebullition is maintained for 2 minutes, and then, without removal of the flame, 3 to 5 drops of a 1 per cent. solution of methylene blue are added. The titration is completed in one minute further. The endpoint is marked by the sudden disappearance of the blue colour, which is especially visible in the surface froth of the boiling liquid.

Tables are given for converting titration volumes of sugar solution to weights of reducing sugar per 100 cc. for solutions containing no sucrose, and for solutions containing 1 gr., 5 gr., 10 gr., and 25 gr., of sucrose per 100 cc. Similar tables are also given for solutions containing reducing sugars in the presence of maltose and of lactose.

Recently Mr. J. S. Mann (*J. Soc. Chem. Ind.* 12th March, 1926, p. 187) has suggested that *dianol green* (obtainable from the British Drug Houses Limited, Graham Street, City Road London, N.1.), is a more satisfactory internal indicator than methylene blue, because its colourless reduction product is not so easily re-oxidized as that of methylene blue, so that its endpoint remains sharply defined for a longer period of time.

TROPICAL WORLD NOTES.

British Guiana.

We understand that a Government Fruit, Vegetable and Products Depôt is to be established in Georgetown, British Guiana. The proposal was originated by Mr. Charles Shankland who, until recently, was Director of Co-operative Credit Societies in the Colony. The Depôt, which will be run on similar lines to the one estab ished in Trinidad, will purchase fruit, vegetables, and other produce from the growers and market them to the Georgetown public. In addition, it will distribute, at the lowest possible prices, seeds of assured quality. It is probable that trial shipments of products will be exported. Considerable quantities of fruit and vegetable are grown in the coastal areas near Georgetown but, owing to the lack of transportation facilities and the existence of a reliable market, little has found its way into Georgetown, with the consequence that considerable quantities of fruit and ground provisions are imported from neighbouring countries in spite of the fact that the Colony is well adapted for their production. The scheme will be worked in close co-operation with the Colonial Transport Department and the Department of Agriculture, special facilities being provided for the marketing of the produce. It is anticipated that the coastal drainage schemes now being elaborated by the Government will minimize the risks of damage by flood. The success of the Depôt will, of course, depend, to a very large extent, upon the ability and personality of its manager, but, it is understood that a suitable applicant has been found. It is believed that when the scheme is functioning smoothly, the Colony will be, to a large extent, independent of foreign supplies of tropical fruits and vegetables. It is alleged that the growers have been exploited by the local dealers who, realising the fact that the peasant must dispose of his produce before returning home, have refused to offer him adequate remuneration for his crops. It is anticipated that the Depôt will overcome this serious obstacle to increased production.

Sumatra.

We learn from the News Edition of *Industrial and Engineering Chemistry*, 10th May, 1926, that the Danish Ostindisk Plantage Selskab has sold its rubber plantations in Sumatra to an English company for some 10 million Kroner. The Danish company was founded in 1918, when it took over a large area of land on the east coast of the island. Part of the concession was subsequently returned, and there are now about 5,400 acres planted with rubber trees, and about 25,000 acres unplanted. Tapping commenced in 1924. The transaction has taken the form of the sale of shares in the Danish company, whose capital is now 6.2 million Kroner.

The Bahamas.

From the 1925 Colonial Office Report (No. 1285) for the Bahamas, we learn that important colonial development projects are shortly to be carried out in that historic British colonial possession. Ever since the abolition of slavery in 1838, the Island has experienced a consistent economic prosperity. Large American interests are inextricably bound up with those of the British in the Bahamas, and an Anglo-American corporation, known as the Grand Bahama Development Coy., is presently negotiating to secure a lease of 430 square miles of Crown land on Grand Bahama, for 99 years. This Company has sought legislative authority to construct a harbour at the west end of the Island, and has also submitted proposals for extensive colonial development and road building. The Crown, however, has retained the right to cancel the proposed lease if the Island is used at any time as a base for "boot eggers." The Island is said to be possessed of one of the finest climates in the world, especially in the winter months of the year, and is adequately adapted for the tourist trade, as, with Governmental assistance, several private companies have constructed hotels, with the provision of amenities for winter visitors. From an agricultural point of view, the Colony has made but little progress, due to the fact that large tracts of vacant Crown land are rocky and, generally unsuitable for cultivation. Then, too, in the depopulated out-islands, there is the difficulty in transporting the crop to Nassau, the capital. Pine-apples, tomatoes, and sisal hemp are the principal products of the island, but, as the production of these and other marketing produce does not keep pace with the growing demand, the industries cannot be described as profitable—hence the attention of the peasants is being turned to labour on the development works where good wages are obtained. The Revenue has increased from £254,019 in 1920-21, to £414,314 in 1924-25, while the Expenditure rose from £269,495 to £409,970 during the same period. The Colony's trade, too, has increased considerably owing to the boom in real estate. The total trade imports for the year under review approximated £1,761,000; while exports reached the sum of £481,000.

Java.

Facts About Sugar notes that the rainfall, at the Experiment Station at Pasoeroean, Java has been much below the average of the preceding ten years. At a number of the mills, the report adds, no rain has fallen for eight months and the general opinion is that a sugar production much smaller than that of 1925 must be expected in 1926. According to the estimate of 21st October the total production of associated mills during the 1925 season was 33,619,747 piculs and that of the non-associated mills 3,924,136 piculs, making a total of 37,543,881 piculs or 2,279,290 long tons.

The Gold Coast.

We have recently received the Prospectus of the Agricultural and Forestry Training Centre at Kumasi, Gold Coast Colony. This Centre was established in December, 1924, for the preliminary training of persons subsequently to be appointed to the staff of the Gold Coast Agricultural and Forestry Departments. The buildings consists of a lecture room, laboratory, office (provided by the generosity of Messrs. Cadbury Bros.), hostel and mess room. Forty students can be accommodated. The course is a three year one, and includes much field practical work in tropical crop production and nursery routine. Agricultural book-keeping, surveying, engineering and elementary economics are included in the subjects taught. The students wear uniform, and are led by Group Captains elected from among themselves. These are responsible to the School Captain, chosen by the Superintendent. Entrance to the school is by examination. Successful candidates are paid £54 in the first year, £60 in the second year, and £66 in the third year of training. The staff consists of the Superintendent of Agriculture and an Assistant Superintendent. The Assistant this year is Mr. W. T. O. Maidment, B.A. (Post-Graduate Student at the Imperial College of Tropical Agriculture from November, 1924 to June, 1925). Mr. B. T. Steemson, B.A. (Post-Graduate Student, November, 1924 to June, 1925) has been acting on the staff, in the absence on leave of the Superintendent, until last month.

British Honduras.

A short article in the Times Trade and Engineering Supplement for April 17, refers to the need of capital for development, and the formation of a department of agriculture for directing agricultural progress is strongly urged.

The climate is said to be healthy, and although the mainland is low and swampy near the coast, it rises in the interior, and while the northern half is flat, hills and mountains characterize the south. There is an ample rainfall; the country is well watered and the soil is rich; all tropical produce grows in abundance in the Colony. Agricultural land is easily obtainable at from $2 to $4 an acre from the Crown, or from private owners at about $5 to $6 an acre. A Government department of agriculture is considered the great *desideratum* of British Honduras at the present time. An agricultural school is being established and steps are being taken towards the formation of a co-operative marketing association for citrus fruit and other agricultural products. Labour presents some difficulty but sooner or later the wood cutters will turn to agriculture and the situation should be improved. Sugar-cane is considered a promising industry for the Colony. At present the chief exports are mahogany and chicle. Many other timbers abound and afforestation is going forward especially for meeting the temporary decline in chicle production. Inland transport is difficult owing to the lack of good roads, but a policy of continued expenditure of about $40,000 a year on roads and bridges promises improved conditions in this respect. The total value of the imports for the year 1925 was over $3,300,000, and the total exports over $3,800,000.

Montserrat.

A successful Agricultural and Industrial Exhibition was recently held at Montserrat, under the auspices of the local Department of Agriculture. The Exhibition was held on the public recreation grounds, under the distinguished patronage of His Excellency the Governor who, however, was unavoidably absent, because the mail steamer from Antigua was not up to time. The show was opened by His Honour the Commissioner.

There was a goodly number of exhibits, which included live stock, sugar products, papain, fruits and vegetables, and minor products as well as preserves, fancy work and sundry miscellaneous exhibits. The exhibits of corn, ginger, vegetables, starches, and fancy work were of a higher standard than of similar exhibits shown on previous occasions. Although cotton is the principal crop of the Island there was no exhibit for this class and this is said to be due to the provision of the Close Season Ordinance. The Montserrat Co., Ltd., however, had a good exhibit of cotton seed oils, meal and cake, as well as of lime juice and lime oils. Amongst the vegetables, a squash weighing 160 lb. was a prominent feature. The exhibit of poultry is said to have been the best ever shown in the Island, while the numbers of horned cattle were very small, although a few good specimens were to be seen. The attendance to the show was good and the exhibition was considered, from every point of view, to have been a success.

Liberia.

Characterising the lease of one million acres of land by the Firestone Tyre and Rubber Company, and the organisation of a $100,000,000 development corporation as a great step forward in the development of Liberia's resources, the *Liberian News* says:—"This mammoth amount of capital for investment in Liberia bespeaks the dawn of a new day for the Republic along all lines of industry, for thousands of dollars will be spent in agricultural and industrial development. This influx of capital will place Liberia on an equality industrially and financially with any of the West African colonies, for it is the most gigantic investment of its kind ever made on the Western Coast of Africa.—*The African World.*

IN our last issue unde the heading 'West Indies," a note was inserted on drought condtiions in areas other than the West Indies and at the same time the word 'British" was inserted before the word Colombia. These errors arose in condensing two notes into one in order to insert the paragraph in the space available.

COTTON IN CUBA.

REQUESTS are frequently received addressed to the Principal of the College or to the Imperial Commissioner of Agriculture, or to some member of the staff whose name has come to the notice of the correspondents as that of an authority of some particular subject, for information and advice on a great variety of subjects. One such request recently received from a business firm in a large city in the United States of America has reference to cotton growing in Cuba and the control of insect pests attacking the crop.

The insects which attract attention at present in Cuba are the Mexican bollweevil (*Anthonomus Grandis*) and the cotton stainer (*Dysdercus ondrae*) Other species of Dysdercus are known to occur in Cuba and may be expected to appear as pests of cotton when the areas cultivated under this crop have increased.

It is stated that a very satisfactory cotton is being grown on a trial scale, and that it is intended to increase the area very considerably if the pests can be controlled, and it is proposed to employ a trained entomologist with a knowledge of cotton and its pests.

At the present time the Entomologists and Agriculturists with special knowledge of cotton and its insect pests are being employed in connection with cotton development in the Empire, as fast as they are being trained in the Empire. The many years of experience in combating the Mexican bollweevil in the United States and the recent campaign against the pink bollworm in certain localities in Texas and Louisiana should have produced capable and experienced Entomologists for this kind of work.

The interest in cotton cultivation for Cuba would appear to be related to the crisis in the sugar industry. Small amounts of cotton were exported from Cuba some 20 years ago but cotton has not appeared in the list of the island's products in more recent years when sugar has so greatly increased. Now, when the enormous crop of cuban sugar has flooded the world's markets and the price has fallen to such a low level, that, as we learn from the public press, the cost of production is more than the value of the canes, it appears that cotton is being looked to as a means of stabilizing the agricultural situation.

In the British West Indian Islands cotton has played an important part within the past 25 years. In Montserrat, Nevis and St. Vincent cotton has been the principal crop of the islands, while in St. Kitts and Barbados it has been a valuable second to the sugar industry. In several other islands also cotton has been of considerable local importance.

The control of pests and diseases is a matter of first necessity and if this is properly considered from the start in opening up a new ndustry the chances of success will be increased. There is the possibility also that new and unknown pests may appear in Cuba, in the same way that the leaf blister mite and the flower-bud maggot made their appearance in the Lesser Antilles.

COTTON NOTES.

Heritable chlorophyll deficiencies in seedling Cotton.

A PAPER with the above title by G. N. Stroman and C. H. Mahoney appears as Bulletin No. 333 of the Texas Experiment Station. The senior author has already made important additions to our knowledge of chlorophyll characters in maize and has now turned his attention to cotton in which deficiencies in the chlorophyll apparatus have not previously been reported.

The work describes the mode of inheritance in cotton of chlorophyll deficiencies of two types. In the first of these the seed leaves are yellow instead of green, and in the second the cotyledons lack the typical green colour in well defined areas.

Yellow seedlings made their appearance in the second generation of Upland Egyptian crosses. The colour appears as a very light greenish yellow in the young cotyledons as they pass through the surface of the soil. The small amount of green pigment soon disappears and the colour of the cotyledons becomes a distinct yellow. The F2 of a Sea Island Upland cross segregated into 63 green and 4 yellow. This is close to a 15 : 1 ratio. Evidence from F3 families is provided and it is concluded that there are two factor pairs involved in the production of yellow seedlings.

The other type of chlorophyll deficiency is shown in certain areas devoid of green colour on the young cotyledons, surrounded by normal green pigment. These areas are not of uniform shape but extend usually from the extreme edge half way across the leaf. In some families the deficient areas are a rich yellow and in other families they are white. It is shown that there are two factors for pattern, and probably a third.

The existence of chlorophyll deficiencies in cotton is of great importance, not only from a scientific but also from a practical point of view. The plants segregating for these factors will produce many plants deficient in vigour, of which most will probably fail to survive the seedling stage.

The writer has since observed both types of chlorophyll deficiencies in the second generation of Acala (Upland) by Pima (Egyptian) crosses. Two yellow seedlings have been raised to the flowering stage and will be crossed with Upland and Egyptian respectively. Both plants have only been induced to survive by greenhouse culture and both are very weak plants with pale yellowish green leaves.

S. C. HARLAND.

ADVERTISEMENTS.

MR. HENRY H. R. MOLE, of Little Neck, Long Island, New York, has been appointed advertising agent for *Tropical Agriculture* in the United States of America and Canada. All communications from those countries respecting advertisements should be addressed to him.

THE UNITED FRUIT COMPANY.

THE twenty-sixth report of the United Fruit Company contains much interesting information regarding the operations of the Company. The net profit for the year amounted to $21,891,705.10, and since dividends for 1925 had been declared in advance and paid out of 1924 earnings the whole amount was credited to profit and loss. The practice of declaring dividends for the entire year in advance has now been discontinued. The total book value of tropical lands and equipment owned by the company stood in 1925 at $107,356,314.56, composed as follows :—

Colombia	$ 7,810,703.05
Costa Rica	9,106,619.18
Cuba	45,942,429.64
Guatemala	4,603,937.64
Honduras	26,185,476.42
Jamaica	4,001,833.85
Panama	8,026,152.10
Canary Islands	1,236,699.84
Nicaragua	442,562.84

The following statement shows the location and acreage of the company's cultivated and improved land :—

Miscellaneous Products.

	Bananas.		Sugar-Cane.		Coconuts.		Cacao.		Other.	
	1925.	1924.	1925.	1924.	1925.	1924.	1925.	1924.	1925.	1924.
Colombia ..	27,032	28,037	..	..	..	..	..	..	..	5
Costa Rica ..	13,959	17,575	..	..	937	1,732	26,425	26,645	2,693	3,368
Cuba ..	..	..	89,896	89,501	..	..	..	..	532	532
Guatemala ..	27,272	28,393	..	1	..	..	129	205	..	5
Honduras ..	82,891	87,808	..	..	518	518	..	..	90	95
Jamaica ..	6,108	6,717	..	223	7,801	8,082	133	158	171	171
Nicaragua ..	..	..	..	..	..	..	..	..	..	..
Panama ..	13,771	17,199	..	..	..	..	23,421	23,124	78	64
Canary Islands ..	1,229	50	..	..	..	..	..	..	163	100
England ..	..	..	..	..	..	..	..	..	..	..
France ..	..	..	..	..	..	..	..	..	..	..
United States ..	..	..	..	..	..	..	..	..	..	..
Total ..	172,262	185,779	89,896	89,725	9,256	10,332	50,108	50,132	3,727	4,340

	Pastures.		Other Acreage.		Total.	
	1925.	1924.	1925.	1924.	1925.	1924.
Colombia	12,015	12,007	9,158	5,676	48,205	45,725
Costa Rica	6,711	6,679	1,974	1,968	52,699	57,967
Cuba	45,677	46,075	21,002	20,940	157,107	157,048
Guatemala	1,685	1,608	629	633	29,715	30,845
Honduras	15,579	15,296	6,766	7,235	105,844	110,952
Jamaica	12,499	12,142	2,070	1,600	28,782	29,093
Nicaragua	..	..	263	262	263	262
Panama	4,498	4,784	1,216	1,233	42,984	46,404
Canary Islands ..	..	..	49	39	1,441	189
England	..	..	13	8	13	8
France	..	..	2	2	2	2
United States ..	..	..	148	150	148	150
Total	98,664	98,591	43,290	39,746	467,203	478,645

Includes acres interplanted :—1925—2,984 ; 1924—4,966.

During the year a regional campaign advertising the food value of bananas was conducted in the New England States and results obtained indicate the desirability of extending the campaign to one of national scope during 1926. The total importation of bananas into the United States during 1925 amounted to 53,962,656 bunches compared with 47,191,936 bunches during the previous year, an increase of approximately 14 per cent. Of this total The United Fruit Company imported 28,225,556 bunches during 1925 or about 53 per cent. of the total. The

output of cacao during 1925 amounted to 8,860,084 lb. as compared with 7,780,868 lb. in 1924. Experiments in intensive cultivation of cacao and improved methods of preparation have resulted in raising the grade of the product.

The Company's sugar crop was produced and milled at lower cost than in any previous year but due to market conditions the net results were unsatisfactory.

THE WATER RELATIONS OF CITRUS TREES.

PROF. F. HARDY, M.A.

THE water relations of plants are of paramount importance as a factor in successful growth. For any particular individual growing in particular surroundings, a balance tends to be established between the moisture content of the plant and that of its environment. Tendencies toward water loss, through evaporation at the leaf surfaces chiefly, are counteracted by water absorption by the roots. If the soil can maintain a suitable water supply, growth proceeds normally, and the plant's tissues remain turgid in spite of rapid evaporation. Increasing aridity of the environment, both soil and atmosphere, causes plant desiccation, and leads not only to loss of turgidity, but also to other, even more noticeable, results.

Aridity may be seasonal, progressive, and eventually severe, or it may be diurnal, fluctuating and relatively slight. Many plants react to seasonal desiccation in that they develop special layers of corky tissue (the so-called abciss layers), which cut off the leaves from the stems, and thus effectively check loss of water by evaporation. The leaves are shed, and the plant enters into a resting condition in which its water stores are conserved. Diurnal desiccation, on the other hand, may lead, not to leaf shedding, but to wilting, which is usually rectified, however, when conditions improve. Nevertheless, even in this case, a plant may react so as to lessen water loss, in that its leaf-pores or stomata may close. The efficiency of stomatal mechanism varies considerably in different plant species.

Plants which bear *succulent fruits* present special features in their water relations. The fruits may hold considerable amounts of water in their tissues, and this water may actually be drawn back into the stems and leaves to make up any seasonal or diurnal deficiencies that may arise there. Thus it has long been known that excessive leaf evaporation may cause a shrinkage of the fruits of the apple, cherry, plum, cucumber, watermelon and tomato (1). In the case of the cotton plant, it has been shown that one cause of abnormal shedding of cotton bolls may be ascribed to desiccation by environmental aridity (2). Similarly, the same factor may cause dropping of apples (3), of oranges (4), and perhaps of coconuts (5). By means of a special measuring apparatus, it is easy to demonstrate that an immediate result of even a slight increase in the aridity of the environment, is a diminution in size of the fruits of such plants as the tomato (6), the walnut (7), and the orange (8).

Recently, the results of a detailed investigation into the water relations of the lemon tree have been published by workers at the Citrus Experiment Station, Riverside, California (9). Among the observations and results obtained during this investigation, the following are worthy of special citation, since they illustrate the great importance of adequate moisture control in Citrus cultivation.

It was first observed that, of the shoots pruned from lemon trees, those which bear attached fruits do not wilt so rapidly as those which do not carry fruits. Lemons attached to pruned shoots become soft and flaccid much more rapidly than lemons which fall from the trees. Furthermore, variations in turgidity may be noted in lemons attached to trees as the atmospheric conditions fluctuate between dryness and moistness. These observations indicate that excessive leaf evaporation may cause a water deficit in the fruits, since, at those times when the roots cannot supply water to the leaves as rapidly as it is evaporated, the fruits act as reservoirs which may be drawn upon to make up a water deficit in the leaves.

Actual measurement with a recording instrument of the diameters of selected fruits growing on lemon trees exposed to different conditions, demonstrated the following facts :

1. On mornings following dewfall, the leaves of lemon trees did not begin to draw water from the fruits until most of the moisture had evaporated from the leaves and from the surrounding vegetation.
2. During long dry summer days, provided dew or clouds were not affecting factors, the lemons began to decrease in size at about 6 a.m., and continued to decrease until 5 to 6 p.m During winter days, the decrease in size began about 9 a.m., and continued until 4 to 5 p.m.
3. Continual withdrawal of water from the fruits by excessive leaf evaporation, may cause lemons to fall, especially when they are young, although fruits of any age may be affected.
4. After several days of excessive atmospheric dryness and windiness, lemons may not regain their previous turgidity at night. A point may be reached, however, when the concentration of solids dissolved in the fruit-juice is sufficiently high to prevent further withdrawal of water, even under extenuating climatic circumstances.
5. Leaf evaporation in the lemon tree appears to take place from the surface of the leaf rather than through stomata, especially in mature leaves, whose stomata seem to

have lost the power of opening. From these observations, the following conclusions may be drawn :—

(*a*) The lemon fruit is well suited to a study of water deficits produced by excessive leaf evaporation, because of its size, water content and flexibility of structure, and because the leaves lack the ability to regulate evaporation. It is probable that other Citrus species will prove equally adapted to similar studies.

(*b*) The lemon fruit is very sensitive to changes in water content of the leaves ; it may become flaccid long before the leaves wilt, or the soil has dried out. For this reason, the amount of moisture in the soil should be kept as high as possible so long as the root system is not injured.

(*c*) During periods of excessive evaporation, there may be not only a daily water deficit but a deficit that may last throughout the night, and for three or four weeks at a time. That such a deficit must have a profound effect on the fruit is self evident. It must materially affect size, texture, amount and kind of dissolved solids, flavour, and keeping quality.

(*d*) Normally grown Citrus fruits possess greatest turgidity in the early morning, and in the late evening, and, when ripe, should preferably be picked at these times.

REFERENCES.

(1) Chandler—" Sap studies with horticultural plants," *Mo. Ag. Exp. Sta. Res. Bul.* 14, 1914.

(2) Lloyd—" The abscission of flower buds and fruits in Gossypium and its relation to environmental changes." *Trans. Roy. Soc. Canada*, 1916, III, 10, p. 55.

(3) Heinicke—" Factors affecting the abscission of flowers and partially developed fruits of the apple," *Cornell. Ag. Exp. Sta. Bul.* 393, 1917.

(4) Coit and Hodgson—"An investigation of the abnormal shedding of young fruits of the Washington navel orange," *Univ. Calif. Publ. Ag. Sci.*, 1919, 3 p. 283.

(5) Gadd—" Nut fall of coconuts," *Dept. Ag. Ceylon, Bul.* 53, 1922.

(6) MacDougal—" The daily course of growth in two types of fruits," *Year book, Carnegie Inst. Washington*, 1919, 18, p. 69.

(7) MacDougal—" Growth in trees and massive organs of plants," *Carnegie Inst. Wash. Publ.* 350, 1924, p. 50.

(8) Hodgson—" Some abnormal water relations in citrus trees," *Univ. Calif. Publ. Ag. Sci.* 1917. 3, p. 37.

(9) Bartholomew, *et. al.*—" Internal decline of lemons, I. Distribution and characteristics ; II. Growth rate, water content and acidity of lemons at different stages of maturity ; III. Water deficit in lemon fruits caused by excessive leaf evaporation," Amer. J. Bot., 1923, p. 67, *ibid.*, p. 117, *ibid.*, 1926, XIII. p. 102.

COTTON GROWING IN SOUTHERN NIGERIA.

IN the Annual Bulletin of the Agricultural Department of Nigeria for 1925, there are a number of papers bearing on the cotton industry of Southern Nigeria. In " A Survey of Factors Affecting the Development of the Cotton Plant in the Oyo and Abeokuta Provinces of Southern Nigeria," T. G. Mason and C. H. Wright sum up the situation as follows :

" In Southern Nigeria a considerable amount of indigenous cotton is grown, only a small proportion of which is exported, the bulk being used in the Native cotton industry. The indigenous cotton is short and coarse, but very strong. Though well suited to the local industry, the value of its staple is too small to render any considerable increase in the proportion exported probable. Attempts have accordingly been made for more than twenty years to replace the indigenous type by American cotton. These attempts have for some reason proved wholly abortive."

In order to try and elucidate the causes of the failure of American cotton, experiments were laid out in two areas, one in the Oyo Province and the other in the Abeokuta Province. The experiments did not reveal any significant difference in the yielding capacities of American and Native cotton. It was shown that the number of open bolls per acre produced by American cotton was in a large measure a func ion of the salt content of the soil, but that in Native cotton the number of bolls was also affected by the hygroscopic coefficient of the subsoil and probably too by damage done by *Helopeltis* and *Pseudomonas*. Damage sustained in the later phases of the boll's development resulted in great loss of crop in both types of cotton. This damage was due to bollworm, internal boll disease and anthracnose. The writers are apparently of the opinion that three separate factors may have operated against the cult vation of American cotton. These factors are, its susceptibility to attack from cotton stainers, and physiological disease referred to as " Leaf Roll," and thirdly its unsuitability as an intercalary crop, for most of the cotton grown in Southern Nigeria is grown in mixed cultivation with maize, yams, &c.

It is pointed out elsewhere in the same Bulletin by Lewin and Mason that in the Ishan district of the Benin Province there are races of cotton belonging to *G. vitifolium* with lint much longer and finer than that at presen under cultivation in the Western Provinces. If long staple strains of this type of cotton can be introduced into the Western Provinces a considerable extension of cotton growing in Southern Nigeria seems probable.

Subscriptions to *Tropical Agriculture* can commence at any time during the year.

SUGAR-CANE INVESTIGATIONS.

PROF. J. SYDNEY DASH, B.S.A.

1. Cultivation Methods.

Results of a number of cultivation methods for sugar-cane, carried out in co-operation with the Trinidad Department of Agriculture, were described on page 95, Vol. II of this Journal. Yields from first ratoons in this series are now available and are given in Table 1. For easy reference, the methods of treatment of the different plots at the time of planting are again reproduced. As ratoons, all received the ordinary cultivation with light implements between the rows.

Plot.	*Treatment.*
1.	Drilled, cuttings planted 7 ft. between the rows and 2 t. in the rows. Pen manure at the rate of 15 tons per acre applied in the drills after canes had made sufficient growth, banks broken at the same time.
2.	Drilled, pen manure at the rate of 15 tons per acre applied in the drills at the time of planting, cuttings inserted through the manure and banks broken. Planting distance 5 ft. by 5 ft
3.	Drilled, sweet potatoes planted on the banks as a catch crop. Cuttings planted 5 ft. by 5 ft. Pen manure applied in the drills at the rate of 15 tons per acre as soon as sweet potatoes were dug, banks broken at the same time.
4.	Cane holes dug about 2 ft. square and 6 in. deep. Planting distance 5 ft. by 5 ft. Pen manure at the rate of 15 tons per acre buried in holes between stools.
5.	Flat planting—no drills or holes made. Well rotted pen manure at the rate of 10 tons per acre stirred in before planting ; distance 5 ft. by 5 ft., lines being marked out by small pony plough.

Table I.—Results—1st Ratoons.

Plot No.	Variety.	Yield per acre, tons cane.	Average, tons cane.
1	Ba. 6032	35.40	38.18
	B.H. 10 (12) ..	40.95	
2	Ba. 6032	36.17	39.81
	B.H. 10 (12) ..	43.45	
3	Ba. 6032	34.30	36.65
	B.H. 10 (12) ..	39.00	
4	Ba. 6032	37.50	39.20
	B.H. 10 (12) ..	40.90	
5	Ba. 6032	28.94	30.89
	B.H. 10 (12) ..	32.83	

A summary of the results from both plants and ratoons are given in Table 2.

Table II—Summary.

Plot.	Yield per acre, tons cane.		Total yield. Tons.
	Plant Canes.	1st Ratoons.	
1	51.82	38.18	90.00
2	57.93	39.81	97.74
3	40.35	36.65	77.00
4	49.83	39.20	89.03
5	46.55	30.89	77.44

It will be seen that plot 2, which was first as plant canes, also occupies the leading place as first ratoons. Plot 1, second as plants, changes place with plot 4—third as plants. Similarly, plots 3 and 5 interchange, occupying fourth and fifth place respectively as first ratoons.

From the totals of the yields for both crops, it will be observed that plot 2 is outstanding with nearly 8 tons of cane per acre more than plot 1, which is second, and this is only 1 ton of cane better than plot 4, next in order ; plots 3 and 5 leave little to choose between them, having yielded considerably below the first three. A glance at the record of the treatment in each case shows that the superior plot (No. 2) received pen manure at the time of planting and had no catch crop grown on the banks, which were broken at the time of insertion of the cuttings. While under certain circumstances a catch or cover crop on cane banks may be grown advantageously, it is the writer's experience that such crops should be eliminated from late fall-planted cane, if yields as plants are not to be prejudiced. Such fields give better results when manured and the banks broken before the dry season has set in.

In respect to variety, while there may be little to choose, from the point of view of total tonnage for the two crops, B.H. 10 (12) shows itself a better ratooner under these conditions. Besides, it is generally recognised as superior to Ba. 6032 as a factory cane. As in the case of the plant canes, there is nothing to indicate that wide spacing of rows with close spacing in the rows offer any special advantage over the more usual planting distance 5 ft. by 5 ft.

2. Variety Tests.

It is next desired to record the yields as first ratoons obtained from certain varieties under observation at the College during the past two seasons. Results from the same varieties as plant canes appear in Vol. II p. 123 of this Journal. The yield of commercial sugar per acre has been similarly calculated for purposes of comparison.

Table III.—1st Ratoons.

Variety.	Cane yield per acre tons.	Brix.	Sucrose in juice per cent.	Purity.	Glucose in juice per cent.	Glucose ratio.	Normal juice per acre tons.	Sucrose in Normal juice per acre tons.	Available Sucrose per acre tons.	Sugar (96°) per acre tons.
SERIES A.										
Ba. 6032 ..	40.15	17.7	14.99	84.67	1.28	7.97	32.12	4.81	4.46	4.65
Badilla ..	32.21	20.3	16.89	83.21	1.21	6.68	25.77	4.35	4.00	4.17
B.H. 10 (12)	32.03	19.2	15.74	81.96	1.60	9.47	25.62	4.03	3.70	3.85
H ? ..	24.50	18.2	15.27	83.89	1.28	7.82	19.60	3.00	2.76	2.88
SERIES B.										
Ba. 11569	60.44	18.8	16.36	87.03	1.23	7.03	48.35	7.91	7.44	7.75
B.H. 10 (12)	58.13	18.9	15.51	82.08	1.95	11.71	46.50	7.21	6.58	6.85
Ba. 6032 ..	51.10	15.3	12.27	80.22	1.63	12.36	40.88	5.02	4.52	4.71
White Tanna ..	43.15	16.1	11.58	71.92	2.81	22.40	34.52	4.00	3.38	3.52
T. 718 ..	32.03	17.3	13.85	80.06	1.60	10.75	25.62	3.55	3.20	3.33
B. 156 ..	46.19	14.3	8.66	60.58	3.21	33.64	36.95	3.20	2.37	2.47

The ratoons in Series A. were from fall-planted cane (1923), first reaped when 16 months old; while those in Series B. were from spring-planted (1924), first reaped when 9½ months old. As ratoons, both series were reaped when approximately one year old. Table 4 gives a summary of the results as plants and first ratoons.

Table IV—Summary.

Variety.	Yield per acre, tons sugar.		Total.
	Plant Canes.	1st Ratoons.	
SERIES A.			
Ba. 6032 ..	6.78	4.65	11.43
B.H. 10 (12)	6.78	3.85	10.63
H. ? ..	5.60	2.88	8.48
Badilla ..	4.02	4.17	8.19
SERIES B.			
Ba. 11569 ..	4.55	7.75	12.30
B.H. 10 (12)	3.92	6.85	10.77
Ba. 6032 ..	3.39	4.71	8.10
White Tanna	2.98	3.52	6.50
T. 718 ..	3.02	3.33	6.35
B. 156 ..	3.83	2.47	6.30

In Series A, the two well-known Barbados varieties out-stripped by a wide margin both the Hawaiian seedling and the Australian Badilla, the latter, however, showing up comparatively well as a ratooner. In Series B, Ba. 11569 gives results which mark it as a cane deserving consideration on soils similar to those existing at the College. In these trials, both as plants and first ratoons, it leads easily, giving 1½ tons of sugar more per acre than B.H. 10 (12). It appears, however, to have at least one drawback agriculturally—poor germinating qualities, unless the soil is in particularly good tilth. This cane has very long joints which make it rather difficult to insert the cuttings completely. In the College plots, too, it showed a slight tendency to develop mosaic disease. Best results as a plantation cane will probably be obtained with it by planting in seasonable weather avoiding soft and sappy planting material.

The other varieties need little comment. In the case of White Tanna it should be said in fairness to this cane that it succeeds best under conditions of heavy rainfall, and the writer has seen remarkable yields from it on volcanic soils with precipitation of 100 inches or more where other canes have been failures.

The rainfall at the College during the 12 months the first ratoons occupied the land was 59.60 inches.

3. Cane Breeding.

A limited amount of this work has been undertaken largely for purposes of student instruction and for collecting material with a view to a scientific study of parent canes. The numerous activities of this Department, short-staffed at the present time, prevent adequate expansion of this line of work. There is much to be done, considering the fact that some varieties may be

excellent parents, although as field canes, their performance has never entitled them to recognition. Of new seedlings under observation during the year, 25 have been selected as deserving of further study. The weights of cane per clump from these at approximately 12 months of age varied between 140 b. and 70 lb. Indeed 25 per cent. gave returns exceeding 100 lb. cane per hole. The quality of the juice in the majority of cases has also been favourable. Thanks are due to the Department of Chemistry for its willing co-operation in the chemical aspects of this work.

4. Germination and Tillering Studies.

A start was made in this direction during the College year 1924-25 and continued in 1926, when careful observations and records were made by a diploma student of this College, on the following varieties :—B.H. 10 (12), B. 156, Badilla, Uba and Ba. 11569; both three-eye and single-eye cuttings were used under ordinary field conditions. Though not yet completed, it is hoped before long that some results of interest will be available.

ESSENTIAL OILS.

IN India and Ceylon the grass family provides material for the preparation of enormous quantities of essential oils.

First in point of quantity comes Ceylon citronella oil. This oil is used on a very large scale in the manufacture of household soap and other cheap perfumery, and to a certain extent for the manufacture of geraniol. The oil of commerce comes over in drums and is always adulterated with petroleum, the amount of adulteration being more or less limited by a solubility test. Pure oil can be obtained by purchasing " Estate oil," but not much of this is imported. A very fine oil is also produced in Burma, the oils from the two countries being quite different in character.

Lemon-grass oil is another important grass oil which comes mostly from India. This oil is the source of citral, from which all artificial violet perfume is manufactured. Palmarosa, ginger-grass, and vetivert oils are also derived from the Indian grasses. Another oil of considerable importance is sandalwood oil. This is almost entirely produced as a monopoly by the Mysore Government, which erected factories so that the oil could be distilled instead of the wood being exported and distilled in Europe. It is used in perfumery and in medicine. Numerous other essential oils are produced in India on a smaller scale and there are enormous possibilities for the extension of the industry of distillation.

The essential oil industry in Australia is chiefly confined to the distillation of eucalyptus oil. Of this there are substantially only two types produced. Of these medicinal eucalyptus oil rich in eucalyptol forms the bulk, and the principal portion of the world's supply comes from Australia. The other variety is the oil, very poor in eucalyptol, which is used for mineral separation. It is usually known as amygdalina oil, but is principally derived from *Eucalyptus Dives*. There are, however, several species of eucalyptus which yield essential oils of high perfume value, but they are not commercial products. It is to be hoped that these eucalypts may be cultivated and a remunerative industry founded on them. In Western Australia an important and successful sandalwood oil distillation industry has been developed in recent years, in spite of the failure of earlier pioneers. This oil so closely resembles the true Indian sandalwood oil that it is not much inferior in perfume value to the latter. The Australian oil is distilled from *Fusanus Spicatus*, and the industry is one specially deserving of encouragement on account of the great difficulties that have been overcome.

The principal part of the world's supply of essential oil of limes comes from the island of Montserrat, and to a lesser extent from Jamaica and Dominica. This is quite an important trade for the West Indies. The oil is used for flavouring and perfumery purposes. Oil of bay used in the preparation of bay rum, and similar toilet articles, is also, in the main, a product of the West Indies, and its distillation is a small but flourishing industry. Another West Indian product is oil of pimento, or allspice.

The industry in cloves is very large, and Zanzibar shares with Pemba the greater part of the production. Distillation plants may be set up on the spot, but at present enormous quantities of cloves are distilled in Great Britain, the United States, and Europe. Clove oil is used for flavouring, but principally in the manufacture of vanillin, which is used on an enormous scale for chocolate flavouring.

A small but important industry is the distillation of cinnamon bark and leaves for oil in Ceylon. A small amount of cinnamon leaf oil is also produced in the Seychelles Islands. Patchouli oil is distilled on a small scale in the Straits Settlements.

The possibilities of developing the essential oil industry in India, Australia, and the West Indies are many and promising, and a good deal of experimental work has been carried out and is being carried out in this direction.

THE CITRUS INDUSTRY.

THERE is no doubt that the value of the orange as an article of diet is now recognised in most countries of the world, and in consequence the consumption *per capita* is rapidly increasing. Especially is this so in the United States of America, where last year it required nearly 120,000 car loads of citrus fruits to satisfy the appetite of the American people. Each of the 120,000,000 people comprising the American markets consumed 58 oranges, 16 lemons and 5 grape fruit. This staggering result has not been achieved by chance, but by well directed publicity work mainly organised by the Californian Fruit Growers' Exchange. The results obtained by this organisation stand out as a shining example of what can be achieved by co-operative effort.—*Rhodesia Agricultural Journal.*

CACAO GRADING IN TRINIDAD.

Tropical Agriculture has recorded, in some detail, the history of the movement for the grading of Trinidad cacao. The object has been not so much to exaggerate the importance either of the industry or of this particular development as to illustrate the difficulties experienced in introducing modern marketing refinements into an old established tropical industry. In the May issue of this Journal the fact was recorded that the Trinidad Chamber of Commerce rejected the proposals of the special committee appointed to formulate a scheme for compulsory grading, in spite of the fact that all the speeches, particularly those by the chief opponents to grading, emphasized the need for, and the beneficial effects of grading. The Agricultural Society subsequently adopted the report, but in view of the opposition of the Chamber of Commerce it was felt that further action upon the proposed lines would be useless. The Society, however, re-affirmed its faith in the principle of grading by appointing a committee, the meeting of which the writer attended by invitation, to draw up a voluntary scheme for grading. The Cocoa Planters' Association, through its Chairman, intimated that it would afford any such approved scheme the fullest measure of support. In view of the position of the Association as a prominent exporter of plantation cacao this gesture is of the greatest importance and we hope that other exporters will similarly offer their assistance.

The scheme is, briefly, this; that a Board should be appointed under the auspices and control of the Society to arrange for the inspection of cocoa and the issue of appropriate certificates to exporters desiring them. The suggested Board is an exceptionally strong and representative one, consisting of six members and a secretary, three to form a *quorum*. This Board would be empowered to form the necessary rules and regulations, and appoint such inspectors as the work may necessitate. The Hon. Carl de Verteuil, C.M.G., is suggested as the first inspector and if this gentleman can be pursuaded to act, the appointment would, the writer feels sure, meet with unanimous approval. It would, of course, be necessary to appoint additional inspectors in order that he might not be placed in the invidious position of having to inspect the cacao of the Cocoa Planters' Association of which he is a Director. The suggested fee, payable in advance, is a minimum of $2.50 (10*s.* 5*d.*) for any number of bags up to 250 bags, and one cent (½d.) per bag afterwards. Of this amount 80 per cent. would be paid by the Board to the inspector, the remaining 20 per cent. being retained for incidental administrative expenses. At the outset it is suggested that there should be only one grade, namely, Plantation, which should be clean and a fair average of the season at the time of shipment. This scheme will be brought before the Society for discussion. In principle the scheme approximates that originally suggested by the writer, but the real investigating of the mechanism of grading and inspecting will only begin when the Board begins to formulate the necessary regulations. With such a strong Board backed by the unanimous support of the Agricultural Society, no insuperable difficulties should present themselves, and if the scheme in operation proves successful no doubt the mercantile community will be the first to clamour for a more comprehensive scheme.

C. Y. SHEPHARD.

GOLD COAST CACAO.

Mr. Aucher Warner's Mission.

MR. AUCHER WARNER, K.C., recently proceeded to the Gold Coast as representative of the Cocoa Producers' Alliance and the Trinidad Co-operative Society of Cocoa Producers with the object of interesting the cacao producers of that area in the objects of the Alliance. With his intimate knowledge of the Trinidad cacao industry and his many other qualifications, Mr. Warner is peculiarly well equipped for such a task and it is unfortunate that an attack of fever should have curtailed his activities, though he was able to complete the major portion of his tour. The suggestion has been made that the West African producers should consent to the levying of a cess upon cacao exports, the proceeds to be devoted to the objects of the Alliance. The writer gathers that the Gold Coast producers object to the proposed cess on the grounds that it is a tax. There are several fundamental differences, however, between a tax and a cess. The one is compulsory the other voluntary. A tax upon an industry is levied, normally, not for the purposes of assisting that particular industry but for general administrative purposes. Even in those countries with representative government the control exercised over such a tax and its expenditure by the industry from which it is drawn, is small and nebulous. In those countries which do not possess representative government such control is negligible. With a cess, the amount, its collection, and its expenditure remain in the hands of those who have voluntarily instituted it and they are in a position at any time to abolish the cess. The merit of a cess lies in the fact that all producers contribute proportionally the same* and all benefit roughly in accordance with the amount of their contributions. The Government is the best authority for collecting such a cess, not because it possesses any superior inherent qualities, but because it already possesses the necessary machinery and can perform this service at minimum cost. The proceeds are placed entirely at the disposal of the representatives of those who contribute the funds. Upon examination the apprehensions of the Gold Coast producers appear to be groundless.

C. Y. SHEPHARD.

* There is some objection to this principle. A progressive rate would be preferable but for the fact that it so complicates the machinery for collecting it that the additional expense outweighs the advantages gained.

LORD MILNER'S APPEAL.

(The following is the Fourth List of Contributions towards the late Lord Milner's Appeal on behalf of the Imperial College of Tropical Agriculture. Later contributions will be published in subsequent issues of "Tropical Agriculture.")

	£	s.	d.
The British Government	15,000	0	0
Imperial Tobacco Co., Ltd.	500	0	0
Manchester Cotton Association, Ltd.	250	0	0
Royal Mail Steam Packet Co., Ltd.	105	0	0
British American Tobacco Co., Ltd.	105	0	0
British South Africa Company	100	0	0
J. S. Fry & Sons, Ltd.	52	10	0
Worshipful Company of Mercers	50	0	0
T. McMorran, Esq.	50	0	0
G. Monro, Esq.	10	10	0
The Earl of Plymouth	10	10	0
Messrs. Burchells	10	10	0
R. Adkin, Esq.	10	0	0
Lord Desborough	5	5	0
Sir James Barrett, K.B.E.	5	5	0
B. C. Forder, Esq.	5	0	0
R. Cecil Wood, Esq.	5	0	0
Lord Queenborough (Balance of $500)	4	3	4
Woodend Rubber & Tea Co., Ltd.	1	1	0
	£16,279	14	4
Previous Lists	29,271	5	2
Total (May, 1926)	£45,550	19	6

VANILLA INDUSTRY OF JAVA.

The Bureau of Commerce of Java makes the following statements about the vanilla industry of that Dutch East Indies colony:

"The Java product is, generally speaking, not so big and handsome as that produced elsewhere, as in Java all blossoms are fructified if possible, whereas in the other countries only the largest blossoms are selected. Quantity rather than quality and the outer appearance is desired in Java.

"The exports from Java are not especially large, but this does not mean that little is produced. In this colony a great deal of vanilla is consumed for home use in preparing cakes, jellies, and other delicacies. There are few households in which this fragrant article is not found.

"In 1916 the Soekaboemi Agricultural Society promised a reward for the best Java-grown vanilla. The 15 samples submitted by competitors, in bundles of 50 sticks each, were passed on for examination to a director of the Colonial Museum in Haarlem to whom they had been forwarded. The committee was composed of a wholesale dealer in vanilla, a chemist, a druggist, an analyst, and a chocolate manufacturer. The chemical research proved that the average percentage of vanilla was 6.9 per cent., for the best samples 7.9 per cent., and 2.7 per cent. for the inferior samples.

"According to information received from the Netherlands Commercial Museum in San Francisco, the Java product should be equal to that from Mexico. The fragrance of Java vanilla is, however, superior.

"The export figures for Netherlands India during recent years have been:—

	1920. Pounds.	1921. Pounds.	1922. Pounds.	1923. Pounds.	1924. Pounds.
Holland	2,064	5,648	2,361	7,304	1,713
United States	14,303	11,656	23,397	36,409	19,460
Great Britain	3,611	—	—	—	3,695
France	—	—	—	705	1,219
Other	452	456	1,164	309	15
Total	20,430	17,760	26,922	44,727	26,102

"Unless prices fall so that the production of vanilla in Java is unprofitable, there will be a considerable increase in the planted area within the next few years as all the planters are expanding their gardens slowly. One buyer has estimated that within the next five years the production of dried vanilla in Java will be 150,000 pounds in normal seasons."—*The Tea and Coffee Trade Journal.*

BOOK REVIEWS.

EXPERIMENTS IN GENETICS.—By Charles Chamberlain Hurst.

Published by Cambridge University Press, pp. xxiv+578, 50*s.* net. In this large and handsomely illustrated volume, Dr. Hurst has put together most of his published work on genetics from 1897 to 1925.—Thirty-eight papers in all. Apart from a feeling of regret that so much material of the elementary text book type has been incorporated, the reviewer has read the book with great interest. One feels that much of what was interesting in 1906 is not so interesting in 1926. Dr. Hurst has covered enormous ground in his researches and genetic workers will always find his results stimulating, even if they do not consider his genetic interpretations always justified by the data.

S. C. HARLAND.

STATISTICAL METHODS FOR RESEARCH WORKERS. By R. A. Fisher.

Published by Oliver and Boyd, London, pp. viii+239 with several tables. This book is one of a series of Biological Monographs by well-known English specialists. The author is Chief Statistician at the Rothamsted Experiment Station, and has interested himself for some years in the statistical interpretation of results accumulated by his fellow workers. His preface is worth quoting from: "little experience is sufficient to show that the traditional machinery of statistical processes is wholly unsuited to the needs of practical research. Not only does it take a cannon to shoot a sparrow, but it misses the sparrow. . . Only by systematically tackling small samples on their merits does it seem possible to apply accurate tests to practical data."

The book is a good and thorough one, and careful study of it will give even the non-mathematical worker an insight into statistical method which will be valuable to him. Throughout the book examples have been worked out from typical biological data, and there are some useful tables at the end in a form not readily accessible elsewhere.

S. C. HARLAND.

Subscriptions to Lord Milner's Appeal for £100,000 as an endowment fund for the Imperial College of Tropical Agriculture should be addressed to the Secretary, Imperial College of Tropical Agriculture or to the bankers of the Fund, the Colonial Bank, 29, Gracechurch Street, E.C.

COLLEGE NEWS.

Dr. E. A. Seagar, lecturer in Sanitation and Hygiene, has been advanced to Professorial Rank.

Sessional examinations commence on 14th June and will continue until 24th June. Term ends on 25th June.

Visitors to the College during the past month included the Hon. Carl de Verteuil, C.M.G., and Mr. Forbes, both of Trinidad.

At the third meeting of the Science Club, held at the College on 27th May, Professor S. C. Harland continued his lecture on "Impressions of the East."

Professor H. A. Ballou has been in charge of *Tropical Agriculture* during the past five months. Professor Shephard has now resumed duties as Editor.

Professor S. C. Harland addressed the members of the Trinidad and Tobago Medical Society on the subject of Human Heredity in Relation to Medical Studies.

At the May meeting of the Agricultural Society of Trinidad and Tobago, Professor S. C. Harland addressed the members on The Pruning of Citrus trees in California.

Owing to the general strike in England the Principal's return to Trinidad has had to be postponed. He sailed on 5th June by the s.s. *Carare* and is due in Trinidad on or about 19th June, 1926.

At the June meeting of the Agricultural Society of Trinidad and Tobago, which was held at the College on 10th June, Dr. C. L. Withycombe, lecturer in Zoology and Entomology, delivered a lecture on The Sugar-cane Froghopper. The lecture was illustrated by a number of lantern slides showing the dusting of fields with insecticides by means of specially adapted aeroplanes.

EAST AFRICA.

COL. FRANKLIN, C.B.E., D.S.O., in a foreword to the Deputy Trade Commissioner's Report on East Africa, refers to the over-optimism in regard to the value of the 1924-25 cotton crop which led to a loosening of credit conditions, followed subsequently by extensions of drafts on maturity and some failures and compromises of Indian merchants on the coast. The Uganda cotton crop which was estimated at 200,000 bales provided a final outturn of approximately 171,000 bales. The congestion of the Uganda Railway held up exports to some degree and resulted in considerable losses to import merchants. In Tanganyika the crops in general were good but heavy losses were made upon the ground-nut crop the local market for which presents merely the most interesting spectacles of gambling by petty traders.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Futures still remain higher than spot prices. The strike considerably hindered distribution and prices for near delivery consequently advanced. A run on refined sugar has been experienced and although stocks are heavy, difficulties are expected if the coal strike continues. Prices on 19th May included, Cubas at 33*s.* 9*d.*, Best Granulated at 30*s.*, West Indian Crystallized at 26*s.* 3*d.* and Muscovado at 22*s.* 6*d.* each per cwt., all showing advances on the previous week.

COTTON.—The after effects of the general strike in the United Kingdom are still being felt, while the coal strike remains an important and increasingly important factor. An advance in prices was experienced owing to unfavourable weather reports in the cotton belt. Subsequent information states that conditions have improved although the crop will be one to three weeks late. This, however, is not a very important factor as there exists ample cotton to carry over to next season. To the end of April consumption in the United States of America amounted to 4,955,000 bales compared with 4,683,000 at the same period of last year. Middling American closed at 10.28*d.* per lb. in Liverpool on 20th May.

CACAO.—Wintery weather has stimulated the demand for cacao. Ceylon Ordinary hardened in price to 102*s.* 6*d.* per cwt. on 19th May, Trinidads declined in price but supplies are being held in anticipation of a rise. Accras strengthened a little. Prices on 19th May included Trinidad Mid Red 70*s.*, an advance of 2*s.* 6*d.* on the previous week, Grenada Fine 57*s.* 6*d.* and Accra Fermented 43*s.* 9*d.* each per cwt. London.

COFFEE.—The expectation of a good crop in Brazil has exercised a somewhat bearish influence upon the market although spot prices, particularly for the quality types, have been well maintained. Jamaica Blue Mountain has remained steady at 205*s.*, Costa Rica Middling advanced by 10*s.* to 165*s.* on 17th May, but afterwards fell to 160*s.* on 19th May, while Kenya Good Middling and Brazil Santos showed no change at 115*s.* and 100*s.* per cwt. respectively.

TEA.—Although the general strike affected the tea market considerable trade was done. Volunteers assisted in removing stocks from bond. All types declined a little in price averages on 19th May being Ceylon 22.28*d.*, Indian 21.00*d.*, Java 16.85*d.* each per lb. Published reports of various Indian and Ceylon Companys indicate the maintenance of exceptional prosperity.

RUBBER.—At the time of the publication of our last report the impending Budget, uncertainties with regard to the Colonial Office attitude towards Restriction, the impending strike, and the unfavourable motoring weather in the United States of America, all exercised a depressing effect on the market. The Exportable Quota for May-July remains at 100 per cent., but if prices fail to average 1*s.* 9*d.* the quota will be reduced to 80 per cent. The general strike slowed down the industry and since its termination the continuation of the coal strike has caused a decline in prices. Spot prices for Crêpe and Smoked Sheet were 1*s.* 10¼*d.* and 1*s.* 10½*d.* respectively on 20th May.

COPRA.—Although fluctuations have been experienced prices generally have favoured sellers. Prices on 19th May included F.A.Q. Ceylon to London £30 7*s.* 9*d.*, Sun-dried Straits to Rotterdam £29 17*s.* 6*d.* and Straits to Marseilles £29 2*s.* 6*d.* each per ton, showing rises of 7*s.* 6*d.*, 17*s.* 6*d.* and £1 2*s.* 6*d.* respectively since our last report.

GROUND-NUTS.—Demand has not been very brisk but prices have shown a further tendency to harden. Quotations on 19th May included Nigerian at £22 5*s.* Chinese at £21 15*s.* and Indian at £21 5*s.* each per ton. Chinese have remained very steady while Indian nuts have shown the greatest fluctuation.

PALM KERNELS.—Holders are asking £20 10*s.* while buyers are offering £20 7*s.* 6*d.*

FERTILIZERS.—Prices show no appreciable change since our last issue. Demand for future dates is small.

PALM KERNEL OIL.—The market for palm kernel oil remained very steady at £42 10*s.* during the first three weeks of April, but during May prices rose slowly but steadily to £44 per ton on 19th May. Soft Lagos fetches £38 10*s.*

RICE.—Carolina sells at £40 per ton and Burmese at £15 15*s.* The market is dull but the fact that stocks are only 65 per cent. of the corresponding holdings of last year tends to buoy up prices.

WE have received from Messrs. Cooper, Pegler & Co., Ltd., their illustrated list of spraying machines and accessories. These include the Vermorel "Eclair" sprayers for fruit tree and garden spraying, lime washing and disinfecting; a very full line of different patterns of sprayers with nozzles, trucks and other accessories as well as spraying material.

Messrs. Cooper, Pegler & Company, Ltd., are regular advertisers in *Tropical Agriculture.*

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